

**STAFF BRIEFING PAPER  
ON  
AGING POWER PLANT STUDY**

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Arnold Schwarzenegger, Governor

# CALIFORNIA ENERGY COMMISSION

Mathew Trask,  
***Principal Author/  
APPS Project Manager***

Kevin Kennedy,  
***IEPR Project Manager***

David Ashuckian,  
***Manager***  
Electricity Assessment Office

Terry O'Brien,  
***Deputy Director***  
Systems Assessment and  
Facilities Siting Division

Robert L. Therkelsen  
***Executive Director***

# STAFF BRIEFING PAPER ON AGING POWER PLANT STUDY

## Introduction

As part of the *2004 Integrated Energy Policy Report (IEPR) Update*, the California Energy Commission is undertaking the Aging Power Plant Study (APPS) to examine the reliability and resource implications of California's reliance on older power plants that may be less reliable and available than facilities built more recently.

More than 40 percent of the total gas-fired power generation capacity in California was built in the 1950s and 1960s. These plants are less efficient and may have increased environmental effects compared to new combined-cycle plants because of improvements in technology and plant design. However, some of these power plants may play a key role in supplying power during times of high demand, especially during a generating shortage, as well as in supplying critical reliability services in various regions.

The staff is refining the study plan for this evaluation. The Energy Commission is seeking participation from interested parties throughout the study process, and is now seeking comment concerning the proposed scope and methodology of the study.

The staff will refine the scope and methodology of the study following a scheduled March 24, 2004, workshop on the subject and review of all comments received from concerned parties (see: [www.energy.ca.gov/2004\\_policy\\_update/notices/index.html](http://www.energy.ca.gov/2004_policy_update/notices/index.html)). Further public workshops will be held to ensure continued participation by interested parties. The staff intends to complete an initial draft of the APPS in July 2004.

## Background

Today, more than 40 percent of the operating generating capacity in California is more than 40 years old. The relative age of this large portion of the state's natural gas-fired power plant fleet was a major issue identified in the Energy Commission's *2003 IEPR*. The *IEPR* is a biennial report in which the Commission assesses the major energy trends and issues facing the state, and uses these results to recommend energy policies that balance broad public interests to conserve resources, protect the environment, ensure energy reliability, enhance the state's economy, and protect public health and safety. The *IEPR* process is guided by a Committee made up of two Commissioners, John L. Geesman, Presiding Member, and James D. Boyd, Associate Member.

During the preparation of the *2003 IEPR*, parties testifying before the Energy Commission identified a variety of issues relating to inefficiency and relatively greater environmental effects produced by older natural gas-fired power plants. The issues raised regarding these plants were three-fold.

Because the lower efficiency of these plants makes them less economically competitive, some parties asserted that a significant portion of these plants may be retired or mothballed in the near future, before replacement generation can be brought online, potentially leading to generating capacity shortfalls in California, as well as local system

reliability problems. Others stated that if the state needs to rely heavily on some of these plants in coming years, they could have adverse effects on natural gas supplies in the state. Finally, some parties were concerned about potential impacts on the environment caused by continued reliance on these plants. Expressed environmental concerns ranged from the potential air quality effects of reliance on plants using outmoded emissions controls equipment to the effects on the marine environment caused by continued use of once-through cooling systems designed more than 40 years ago.

The interaction between these issues is complex. For example, the least efficient plants are likely to be little used in normal years, and therefore have little effect on natural gas use or the environment. The reduced operation, however, may increase the possibility that plant owners would decide to close these facilities for economic reasons. Conversely, during periods of high demand, combined with a resource shortage, generation from these aging plants may significantly increase, absent continued development of new power plants or other alternatives, such as new transmission lines or demand-side management. Continued use of these aging power plants, therefore, could have implications for the demand and price of natural gas in the state, as well as contribute to ongoing cumulative environmental impacts at a greater rate compared to the use of newer power plants.

In the 2003 *IEPR*, the Energy Commission noted that reserve margins in the state are affected by the retirement of older generating units. Estimates of the amount of capacity that could be retired over the next several years range from 4630 MW by the Energy Commission, to 7232 MW by the California Independent System Operator (CA ISO), to as much as 10,000 MW by merchant generators. In addition to their capacity contributions toward reserve margins, some of these aging power plants provide important local reliability services, such as voltage or frequency support in areas where transmission systems are constrained.

To address these wide-ranging concerns, the 2004 *IEPR* Committee directed staff to prepare an APPS as part of the 2004 *Update* to the 2003 *IEPR*. The APPS has three main objectives:

- analyze the role that individual aging power plants play in maintaining a reliable power system, including capacity resources and local reliability services;
- examine in more detail the range of retirements that can be anticipated over the next few years; and
- assess the implications of these potential retirements on system reliability and efficiency, and the environment.

## **The Study Process**

This APPS will provide information to the Energy Commission and others concerning the role these aging plants presently play in meeting the needs of the state's electricity system, as well as the resource implications of continued reliance on these plants, both

in terms of natural gas use and environmental effects. The study will also provide information concerning the anticipated future role these plants will play in the state's power market. The study will assess the effect on electric reliability from the retirement of less-efficient generating units for economic reasons, as well as to identify regions within the state that may be especially vulnerable to the loss of generating resources. The study will also help identify trends related to factors that affect the rate of retirement and forced outages at older plants.

The staff has tentatively identified a group of older power plants for use in studying the current and anticipated role of aging plants in the state's electricity system and their impacts on the state's resources. The staff used criteria based on a combination of several attributes, including age, size, capacity factor, efficiency, and environmental considerations, to produce the attached list of plants as a preliminary study group for the APPS. The proposed list of power plants is not meant to be exhaustive, nor to suggest that the plants included in the study should be shutdown, retrofited, repowered, or targeted for any other specific action, or that these plants are not in compliance with all the laws, ordinances, and regulations applicable to their operation. Rather, the list is a starting point to use in examining the various issues associated with aging plants, and the potential role they might play in meeting electricity demand in the state in coming years. The staff expects to revise the list based on comments received from interested parties.

#### *Study Group Selection*

The staff formed the study group list by culling down a database of more than 1,500 generating units in the state. The list was reduced to 519 units by identifying those built before 1980, and 193 of those are fueled by natural gas. Eliminating units smaller than 10 MW reduced the list to 165. Eliminating the stand-alone combustion-turbine units, which are designed to operate only during peak periods, and units not connected to the grid, and consolidating the combustion turbines and steam turbines of the combined-cycle units, further narrowed the list to 95 units. Of those, 29 units are known to be scheduled for retirement in the near-term, bringing the list down to 66 units. The Energy Commission has access to some data for all but five of the 66 units.

This preliminary selection is meant to provide a representational sampling of those larger plants with relatively higher heat rates (low efficiencies) and relatively higher operation (capacity factors), as well as a sampling representing plants that have particular environmental characteristics. Peaking plants were generally eliminated from the study group, because they are designed to run only during periods of high demand, while remaining idle for the balance of the year. Also eliminated were aging biomass, hydroelectric, nuclear, wind, and solar plants.

The staff is also developing criteria for identifying particular generating units where increasing operations of the units or extending their lifetimes could have unwanted environmental effects. In applying the criteria, the staff will consider four basic factors related to environmental performance: air emissions and emission rates; cooling water sources and treatment of waste water discharge; indigenous flora and fauna and related habitat and wetlands; and community plans for reuse of the power plant site.

Many environmental attributes of power plant units can be measured by their performance with respect to specific criteria: NO<sub>x</sub> emissions, water source, the cooling method used, and compatibility with surrounding land uses. Others require closer examination of localized effects, such as on wetlands or local populations of plants and animals, and community concerns regarding compatibility with surrounding land uses. These factors are often best described in a qualitative way because they are not numerical items (e.g., a city's long range plan for use of a waterfront area, or a redevelopment area plan) or because of a lack of specific data.

#### *Data and Information Collection*

The staff may revise the list of units proposed as the study group based on comments received and new information discovered during the workshop process. Once the list for the selected group is finalized, the staff will gather data concerning the operational history of the plants, with emphasis on how they operated in the past two years, compared to how they operated during the "power emergency" of 2000-2001, which may provide predictive value for the intermediate term, when generation reserve margins may decline.

The staff also will collect information from various sources concerning the contracted services the plants provide. Such services would include any contracted energy and capacity sales, such as with the state's Department of Water Resources, as well as contracted reliability services – such as voltage or frequency support or spinning reserves – supplied to the CA ISO or other control area operators.

The staff will also collect data related to air emissions and other readily quantifiable parameters, and conduct a qualitative assessment of other environmental effects, such as the effects on biological resources from the once-through cooling systems used by some aging plants. The staff will also attempt to describe the potential cumulative environmental effects from the aging plants, to the extent that such effects can be readily ascertained. Finally, the staff will also identify regionally important issues, such as transmission bottlenecks and gas pipeline infrastructure limitations, that relate to the need for provision of reliability services from a particular plant or group of plants.

#### *Future Role Analysis*

The next step in the study will be to assess the role these plants may play in the California electricity generation system in the near to intermediate future. The staff is currently crafting a proposed methodology for conducting this part of the analysis, based on assigning risk factors for the retirement of groups of units and conducting supply/demand balance calculations under a wide variety of likely and theoretical maximum scenarios.

The staff intends to analyze a range of potential future scenarios, assuming a range of plant retirements, and will also likely create "perfect storm" scenarios – where several factors align to create the worst possible case related to both gas and electric reliability – to show the extreme end of the range of possibilities. The analysis will also take into account a range of possibilities concerning other development in the energy industry, as well as the effects of present policies concerning the continued use of these aging plants. Factors that could affect the analysis include the development of new electric

transmission lines, and new or refurbished power plants, as well as the state's policies concerning renewable energy development and demand-side management.

### ***Study Results***

The final phase of the study will involve compilation and interpretation of the results of the analysis, with the goal of identifying potential issues related to both the continued reliance on aging power plants, as well as the potential effects from their retirement or extended shutdown for corrective maintenance. The staff will identify regions that are particularly vulnerable to supply problems because of the loss of one or more aging plants, as well as on the potential effects on the natural gas system from reliance on these plants. The staff will also place emphasis on identifying environmental concerns related to the continued operation of the plants, including air emissions, water quality, and biological resources. The results of the analysis will be documented in the Draft APPS. After considering all comments received on the draft document, and conducting any needed additional analysis, the staff will update the report at the Committee's direction, for inclusion in the *2004 IEPR Update*.

### **Study Schedule**

The staff intends to complete a draft of the study in July 2004. To ensure continued participation in the study process, the IEPR Committee intends to hold a series of workshops throughout the process, beginning with a scheduled March 24, 2004, workshop. The purpose of this workshop is to provide an opportunity for all parties to participate in the Aging Power Plant Study process and to provide a forum for discussing the goals and mechanics of the study. The workshop will include presentations by staff to focus the discussion on four main points:

1. The major issues associated with aging plants that this study will focus on,
2. The criteria that was used initially to select the power plants for more detailed examination,
3. The information and analytical tools needed to adequately examine the issues associated with aging power plants, and
4. The methodology to be used in analyzing the potential effects of continued reliance on aging plants.

The Committee will revise the list of plants selected for study, and the proposed methodology for completing the study, following review of comments received from interested parties during and after the first workshop. The schedule and need for additional workshops will likely be revised during the process to fit the needs of the study participants. The staff intends to publish the Aging Power Plant Study in July 2004.

### **Comments**

Comments from interested parties will be taken throughout the APPS process, beginning with comments on the four points of discussion listed above. In addition, the Committee is aware that work is ongoing at other agencies that will strongly influence

the issues examined in the APPS, particularly the California Public Utilities Commission's proceedings on procurement and resource adequacy. The Committee is seeking comment from workshop participants as to what value the APPS can add to the debate. Specifically, the Committee is seeking comments on the topics outlined above, plus a list of questions contained in Attachment A. The Committee encourages interested parties to present their views either orally at the workshop or through written comments. Parties wishing to comment are requested to contact Matt Trask at (916) 654-4067 or by e-mail at: [mtrask@energy.state.ca.us](mailto:mtrask@energy.state.ca.us).



**Attachment A**  
**Questions on Aging Power Plants**

- Has the Committee captured the issues associated with aging plants that this study should focus on?
- What criteria should be considered for selecting power plants for the study?
- Should certain power plants be included or excluded from the initial selected group for study and why?
- What information should the Committee consider, and what data should the staff collect in conducting the APPS?
- What methodology should staff employ to assess the role these plants play in the state's power market accurately?
- What policies, plans, and practices are in place that might cause the retirement of these plants?
- What policies, plans, and practices are in place that might cause these plants to remain in operation?
- What are the best means to secure generation capacity, reduce uncertainty from operation, improve resource efficiency, and reduce environmental impacts at these plants?
- What are the potential environmental effects of any replacement units, and will there be an improvement?
- Will replacement units be available and reliable?
- What are the local fiscal impacts of aging plant retirement?